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Banning, R.;

Instrumentation and Measurement, IEEE Transactions on , Volume: 46 , Issue 4 , Aug. 1997
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Linear interpolation, extrapolation, and prediction of random space-time fields with a limited domain of measurement

Petersen, D. Middleton, D.

This paper appears in: Information Theory, IEEE Transactions on

Publication Date: Jan 1965

On page(s): 18 - 30

Volume: 11, Issue: 1

ISSN: 0018-9448

Abstract:

Formulas are derived for linear (least-square) reconstruction of multidimensional (e.g., space-time) **random** fields from **sample** measurements taken over a limited region of observation. Data may or may not be contaminated with additive noise. Sampling points may or may not be constrained to lie on a periodic grid. The solution of the optimum filter problem in wave-number space is possible under certain restrictive conditions: 1) that the sampling locations be periodic and occupy a sector of the Euclidean sampling space, and 2) that the wave-number spectrum be factorable into components, one of which represents a function nonzero only within the **data** space and the other only within the sector. If the continuous field is accessible before sampling, a prefiltering operation can, in general, reduce the subsequent error of reconstruction. However, the determination of the optimum filter functions is exceedingly difficult, except under very special circumstances. A one-dimensional second-order Butterworth process is used to model the effects of various postulated constraints on the sampling and filtering configuration.

Index Terms:

[Extrapolation](#) | [Interpolation](#) | [Least-squares estimation](#) | [Multidimensional signal processing](#) | [Prediction methods](#)

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Spectral analysis methods for Poisson sampled measurements

Banning, R.

Dept. of Appl. Phys., Delft Univ. of Technol., Netherlands;

*This paper appears in: **Instrumentation and Measurement, IEEE Transac***

Publication Date: Aug. 1997

On page(s): 882 - 887

Volume: 46 , Issue: 4

ISSN: 0018-9456

Reference Cited: 5

CODEN: IEIMAO

Inspec Accession Number: 5756204

Abstract:

The velocity measurements for turbulent flow regimes obtained with laser Doppler anemometry are not only affected by random noise but are also unevenly spaced. The usual spectral estimators rely on evenly **spaced data** points. It would appear that the measurement data requires adjustment before it can be passed on to estimators. In this paper, both an analysis method with a novel adjustment scheme as well as an analysis method which does not rely on the use of adjustment scheme are presented.

Index Terms:

[Kalman filters](#) [anemometers](#) [anemometry](#) [discrete Fourier transforms](#) [flow measurement](#) [velocimetry](#) [sampled data systems](#) [spectral analysis](#) [Kalman filtering](#) [Poisson sampled data](#) [measurements](#) [discrete Fourier transforms](#) [laser Doppler anemometry](#) [measurement](#) [random noise](#) [sampled data systems](#) [spectral analysis](#) [spectral estimators](#) [stochastic](#) [turbulent flow](#) [velocity measurement](#)

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1, B. D. O. Anderson and J. B. Moore, *Optimal Filtering*. Englewood Cliffs, NJ: Prentice Hall, 1979.